length. He has traced the spinal nerves, not only the nerve-roots, but also the trunks and the plexuses, as a centrifugal growth from the spinal cord. The growth of the nerves is both interstitial and terminal. They consist at first of rounded cells, in an active state of proliferation; in older embryos these become ovoid, and finally fusiform. These fusiform cells, by the alteration of their protoplasm, become converted into nerve-fibres. The development of the nerves in the limbs takes place as follows: The primitive nerve grows out beyond the lower end of the muscle-plate, and reaches the root of the limb. It there spreads out into an irregular series of processes, which pass into the undifferentiated tissue of the limb. These branches, later, arrange themselves in two trunks, one dorsal, the other ventral, which extend still farther into the limb and enclose between them a mass of blastema, from which the cartilaginous basis of the limb is formed. The dorsal and ventral trunks fuse with adjacent dorsal and ventral trunks to form two broad flat bands, from which, still later, the individual nerves as found in the adult are produced. F. T.

II.—EXPERIMENTAL.

Studien über Licht- und Farbenempfindung. A. EUGEN FICK. Pflüger's Archiv, Vol. 43, p. 441.

This valuable set of experiments on the limits of the light-sense and the color-sense, which were carried out with the assistance of Fräulein N. Fick, throw doubt on a number of results apparently obtained by Charpentier, and also serve to settle some other points which have been for some time in dispute. A former observation, the correctness of which was denied by Charpentier, is, in the first place, confirmed, namely, that the color of several separate small points is more readily detected than that of one of them. It is then pointed out that the results of Charpentier's quantitative experiments, in regard to the threshold for light and color, show an agreement which would be impossible if they had been conducted with sufficient care, and it is shown that they are in fact erroneous. Any absolute determination of a threshold for the perception of the light and color of a small faint object in an otherwise dark field is proved to be an impossible task, owing to the very great differences of sensitiveness exhibited by different individuals, and by the same individual from day to day, or even from moment to moment, and owing also to the different degree of sensitiveness of different portions of the retina, combined with the impossibility of keeping the eye steady when looking at a dark field. The facts in regard to the latter point have been variously set down,—Aubert and Erdmann, for instance, believing that any apparent difference between the fovea and the adjacent parts of the retina is due to the more rapid fatigue of the latter, and disappears after adaptation has taken place. This Fick shows to be very far from being the case. He secured good fixation by introducing two minute bright points above and below, and looking at a point half way between them. He found that the light-sense and the color-sense present opposite phenomena; the latter is more acute and the former is less acute at the fovea than at the other portions of the macula lutea. The sensitiveness for light reaches a maximum on the temporal side of the eye, somewhere

from 7° to 15° away from the centre; it is here from ten to twenty times as great as at the fovea, which is in all cases the lowest point of the curve. Different individuals furnish curves which differ very much in detail; Fräulein N. had a "fabulous" power of detecting faint lights and colors, but even for her the sensitiveness to light outside of the fovea was two or three times greater than at it. But, for the detection of color, the general shape of the curve is reversed. All colors (if the eye has undergone adaptation by the observer's remaining for fifteen minutes in a dark room) are best perceived at the fovea. Red light has the peculiarity to be seen to be light and to be red at very nearly the same instant, at the fovea. For all other colors much less illumination is necessary to see them than to name them, even at the fovea, and beyond it the difference increases rapidly.

Charpentier stated that the color of a group of points can be named sooner than they can be counted, and exactly four times sooner for all colors. Fick found that so simple a rule is far from holding; a small number of yellow points, for instance, were counted with six times less illumination than was necessary for distinguishing their color. C. L. F.

Ueber das Verhalten der normalen Adaptation. TREITEL. Graefe's Arch. f. Ophth. XXXIII, 2, p. 73.

Aubert found that the sensitiveness of the eye was increased 35-fold by remaining for two hours in a darkened room. Landolt found that with increasing adaptation, the order in which the colors were recognized was green, yellow, red, blue, violet. Treitel, by first blinding the eyes, obtained a difference of visual power of 120-fold. After fatiguing by different colors, the order of recovery for the different colors was as follows:

After Red-fatigue	G, B, Y, R.
" Blue "	Y, R, G, B.
" Green "	R, B, Y, G.
" Yellow "	R, B, G, Y.

The fatigue must take place in the retina, for it proceeds in the two eyes independently of each other. The fovea is much slower in recovering than the lateral portions of the eye. The coincidence between the time which is required for adaptation to take place and for the visual purple (or rod-purple, as it ought to be called) to become restored, points to a connection between the two processes. This is confirmed by the fact that symptomatic night-blindness occurs with diseases of the eye which attack the pigment-epithelium. Idiopathic night-blindness is always a result of excessive exposure to light; in a poor state of nutrition, among old people, for instance, a slight exposure is sufficient to bring it on.

Die Analyse der Lichtwellen durch das Auge. A. GÖLLER. Du Bois-Reymond's Archiv, 1888, I and II, p. 139.

If natural white light is first polarized, then passed through a thin piece of quartz, and then examined by an analysing prism, it will be found that the quartz has had the effect of rotating the plane of polarization, but by a different amount for the different colors. If